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(54) **BALLAST FOR LOCOMOTIVES**

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B61C 17/00 (2006.01)

(52) **U.S. Cl.**
CPC ***B61C 17/00*** (2013.01)

(58) **Field of Classification Search**
CPC B65D 2519/00796; B61C 17/00
USPC 105/26.05, 73, 75
See application file for complete search history.

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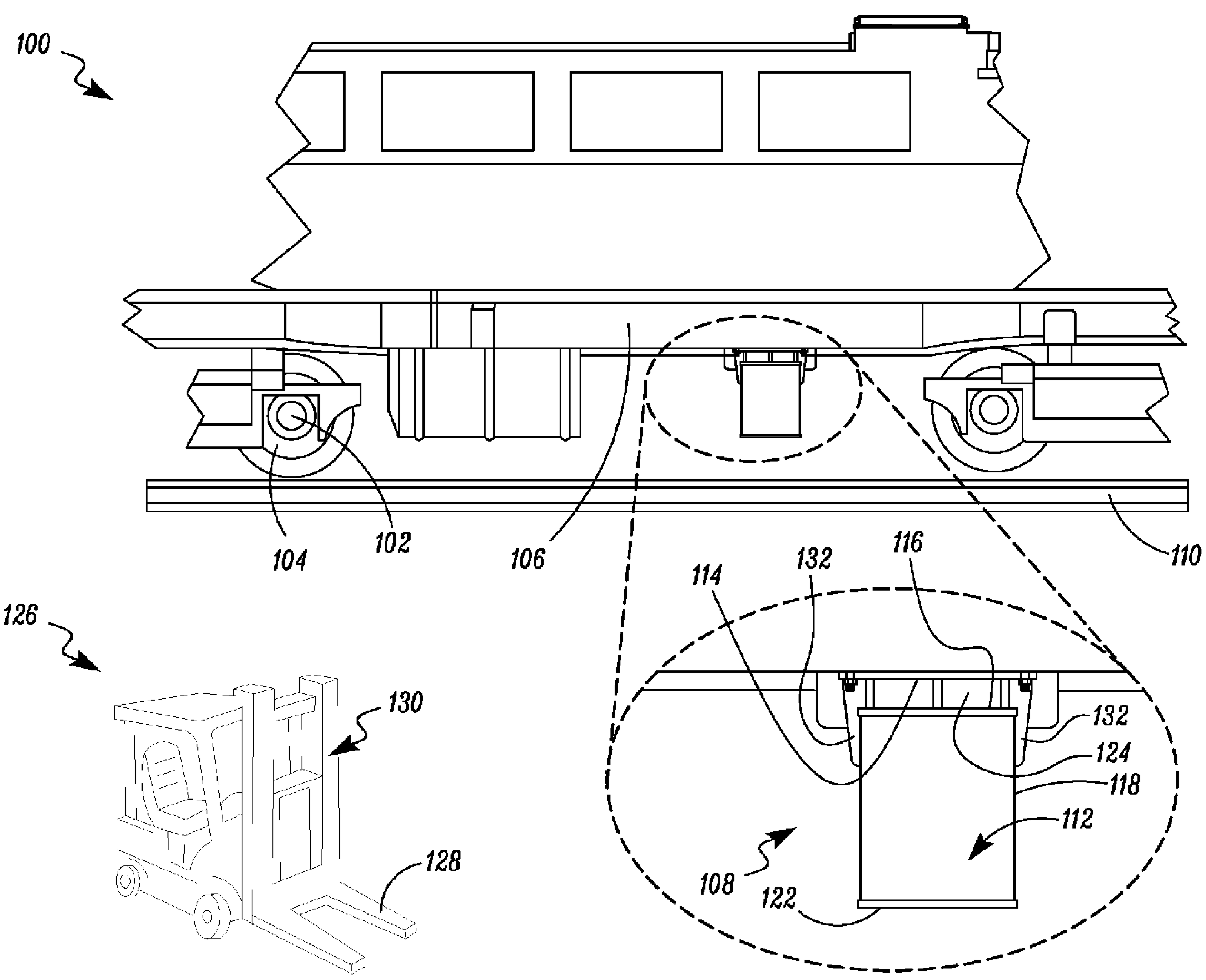
(57) **ABSTRACT**

A ballast is configured to be selectively coupled to a chassis of a locomotive based on an anticipated change in axle load capacity of a rail. The ballast includes a container, a lid, and a catch plate. The container includes one or more sides and is configured to store a heavy mass of material therein. The lid is disposed on one of a bottom and lateral sides of the container. The catch plate is spaced apart and rigidly attached to the container to define a pocket therebetween. The pockets are configured to allow one or more lifting implements to be inserted such that the container may be hoisted and selectively coupled to the chassis.

19 Claims, 5 Drawing Sheets



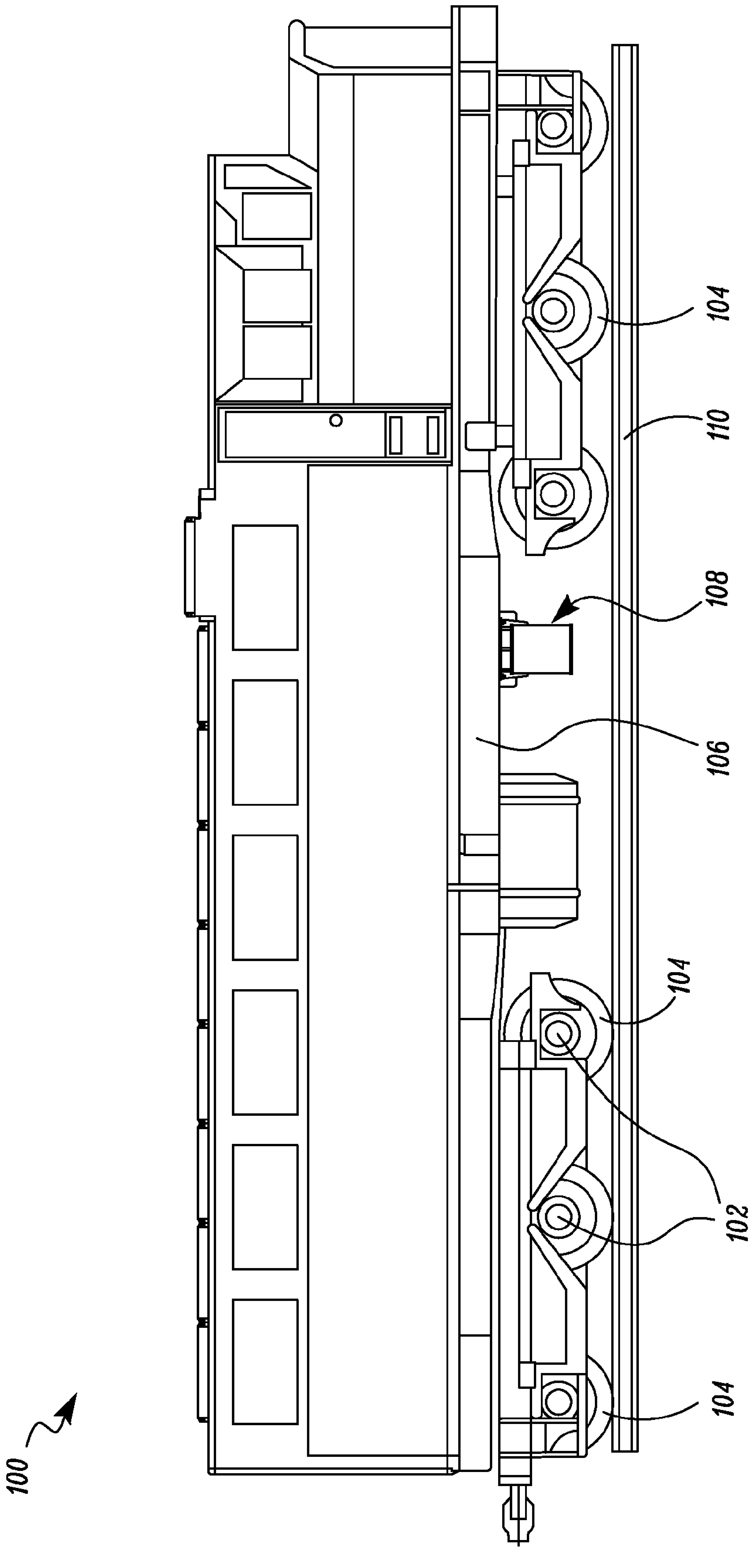


FIG. 1

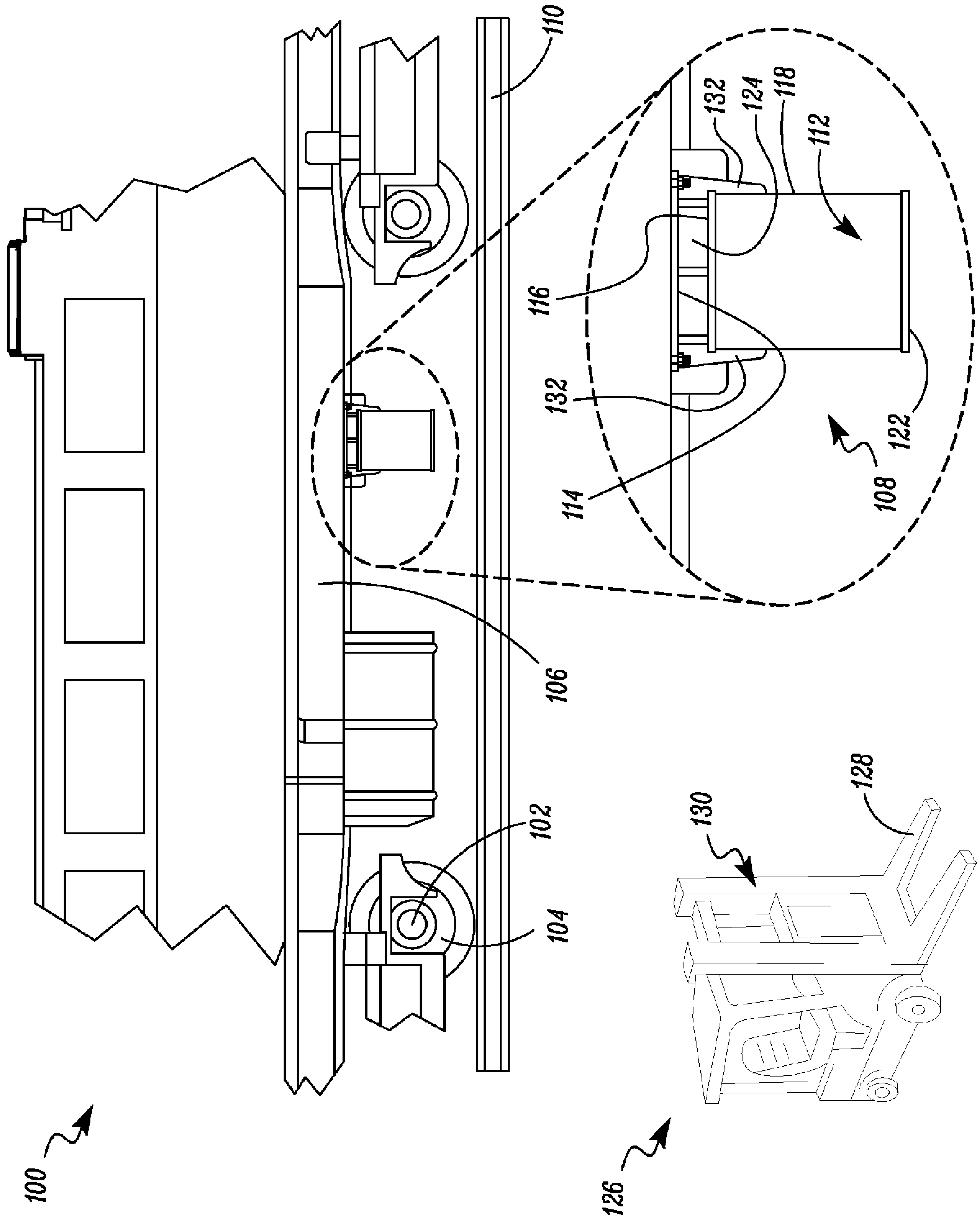


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FIG. 2

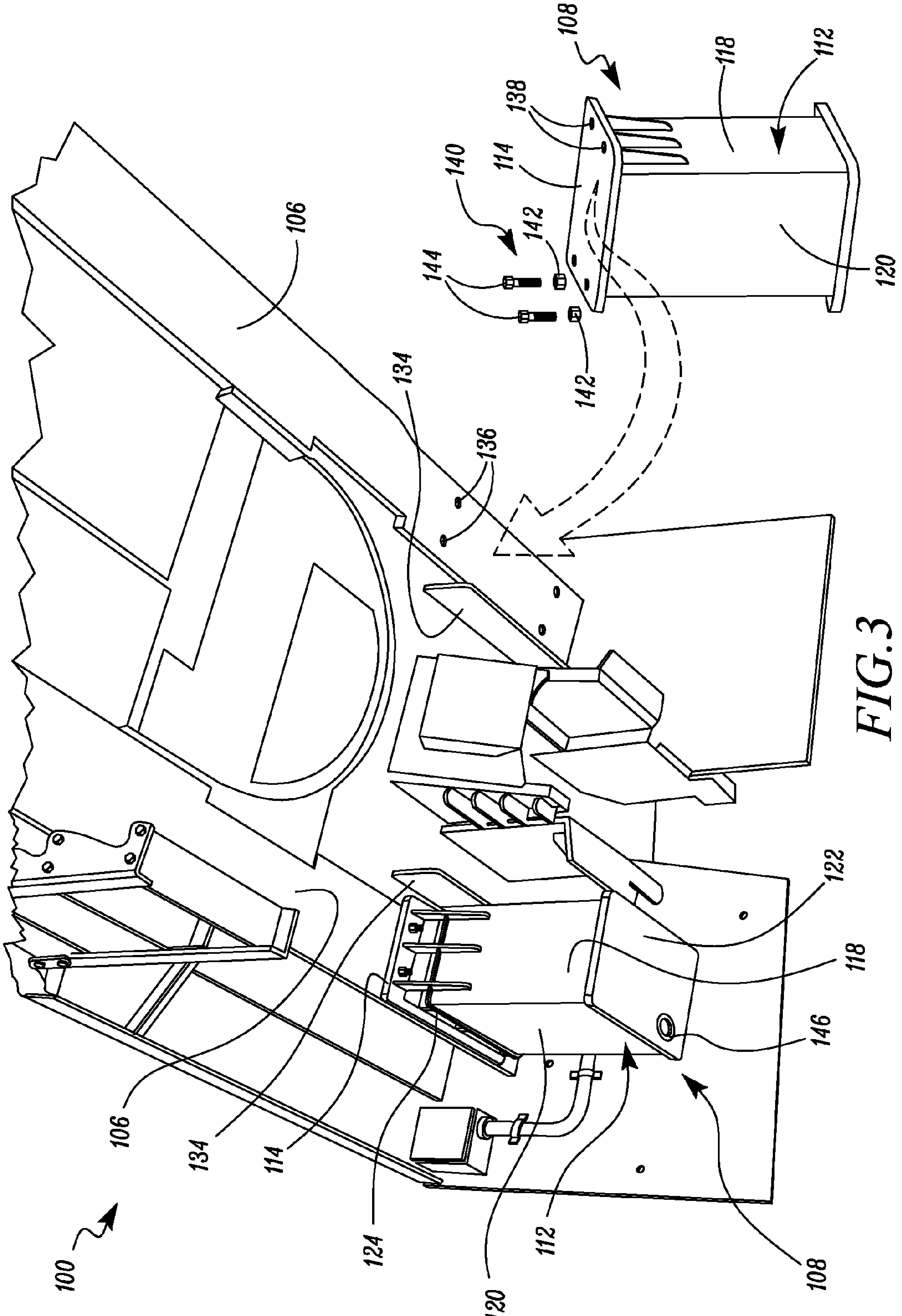
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FIG.3

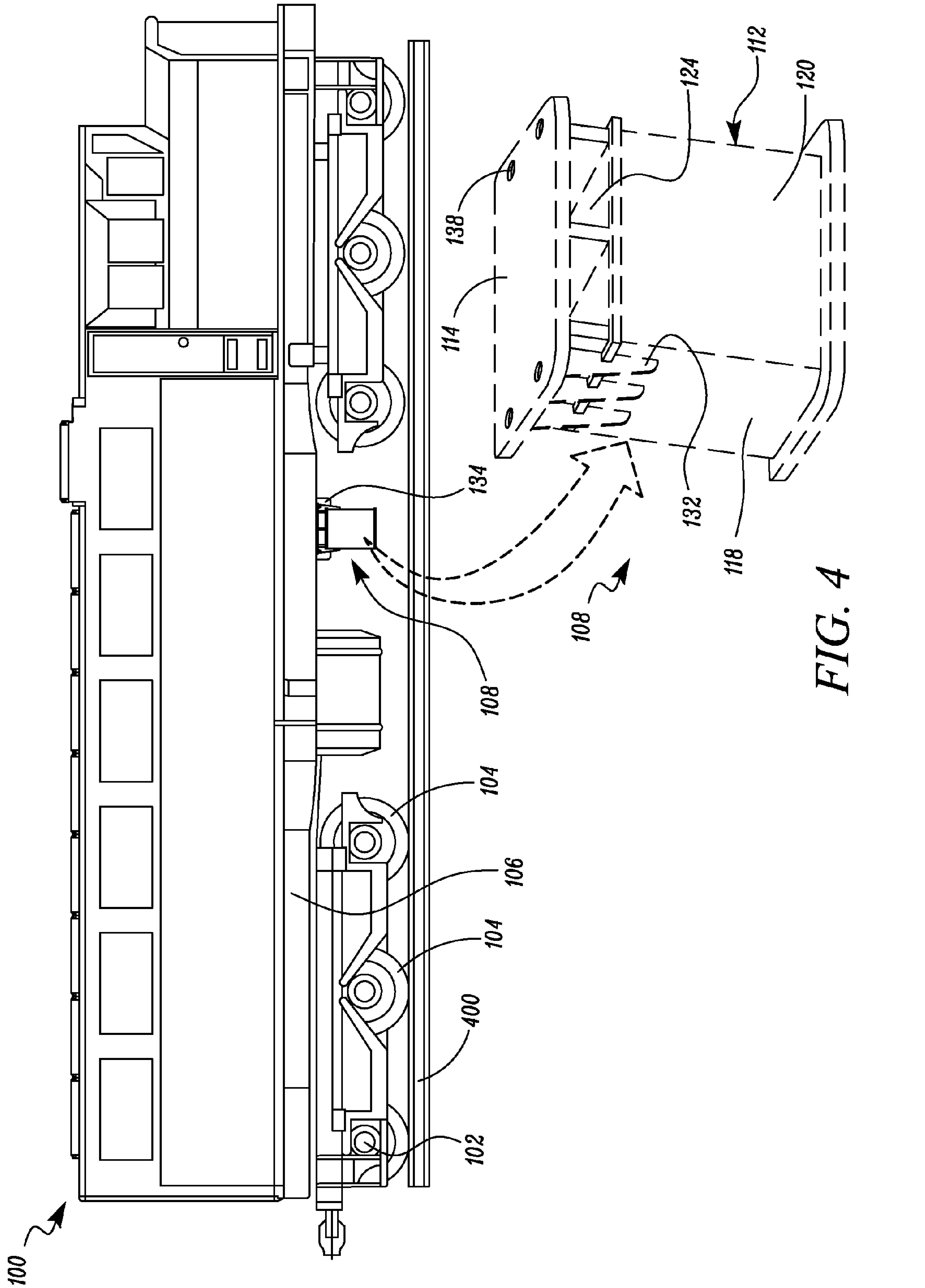

FIG. 4

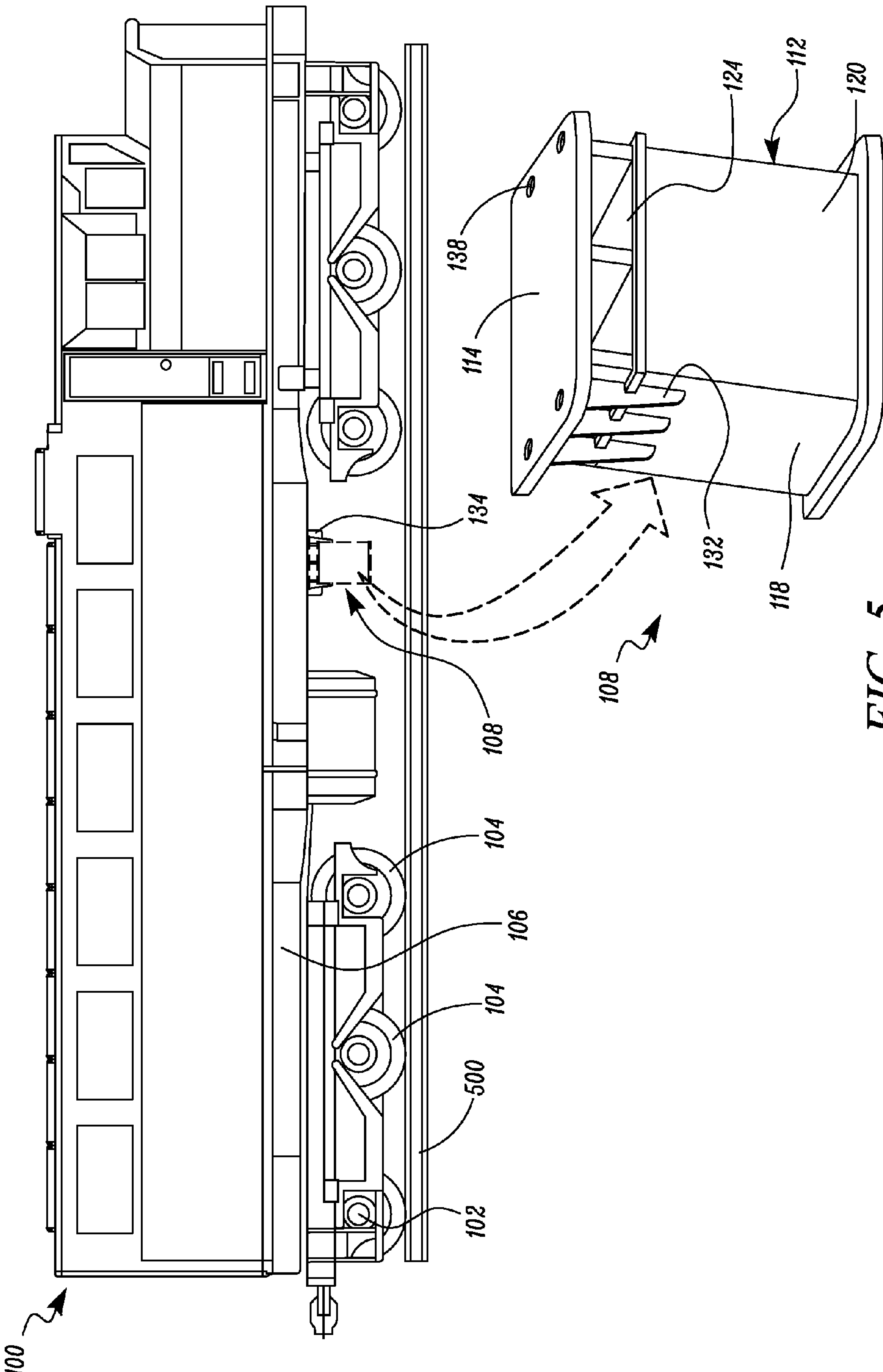

FIG. 5

BALLAST FOR LOCOMOTIVES

TECHNICAL FIELD

The present disclosure relates to a locomotive, and more particularly to a ballast for a locomotive configured to run on rails of varying axle load capacities.

BACKGROUND

Axle load capacities of rails vary from one rail to another. A first rail may be able to withstand a heavy axle load of a locomotive while a second rail may be able to withstand a lighter axle load as compared to the first rail. Typically, locomotives may be of different gross weights and may vary from manufacturer to manufacturer. However, these gross weights must comply with the rail capacities at all instants of time. In order to do so, each axle of the locomotive may need to comply with the axle load capacity requirements of the rail. Several methods previously known in the art accomplish adjustments to the gross weight of the locomotives. However, these previously know methods are typically permanent in nature and may not be adjustable after initial manufacture of the respective structures. Further, any adjustment to a weight of the locomotive while in service may be tedious and cumbersome.

SUMMARY

In one aspect, the present disclosure provides a ballast configured to be selectively coupled to a chassis of a locomotive based on an anticipated change in axle load capacity of a rail. The ballast includes a container, a lid, and a catch plate. The container includes one or more sides and is configured to store a heavy mass of material therein. The lid is disposed on one of a bottom and lateral sides of the container. The catch plate is spaced apart and rigidly attached to the container to define a pocket therebetween. The pockets are configured to allow one or more lifting implements to be inserted such that the container may be hoisted and selectively coupled to the chassis.

In another aspect, the present disclosure provides a locomotive configured to run on a rail. The locomotive includes two or more axles, a chassis disposed on the axles, and one or more ballasts selectively coupled to the chassis based on an anticipated change in axle load capacity of the rail. The ballast includes a container, a lid, and a catch plate. The container includes one or more sides and is configured to store a heavy mass of material therein. The lid is disposed on one of a bottom and lateral sides of the container. The catch plate is spaced apart and rigidly attached to the container to define a pocket therebetween. The pockets are configured to allow one or more lifting implements to be inserted such that the container may be hoisted and selectively coupled to the chassis.

Other features and aspects of this disclosure will be apparent from the following description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of a locomotive in accordance with an embodiment of the present disclosure;

FIG. **2** is a breakaway side view of the locomotive showing a ballast;

FIG. **3** is a view of an underside of the locomotive showing the ballast;

FIGS. **4-5** illustrate a side view of the locomotive and a rail in accordance with various embodiments of the present disclosure.

DETAILED DESCRIPTION

The present disclosure relates to a locomotive configured to run on rails of varying axle load capacities. FIG. **1** shows a side view of the locomotive **100** in which disclosed embodiments may be implemented. In an embodiment, the locomotive **100** may be an industrial locomotive configured to pull cargo containers (not shown). In another embodiment, the locomotive **100** may be a commercial locomotive configured to pull passenger cars (not shown).

The locomotive **100** includes two or more axles **102**. In an embodiment as shown in FIG. **1**, the locomotive **100** may include six axles **102** associated with wheels **104**. The locomotive **100** may further include a chassis **106** disposed on the axles **102**. The locomotive **100** includes one or more ballast **108** selectively coupled to the chassis **106** based on an anticipated change in axle load capacity of the rail **110**.

In an embodiment as shown in FIG. **2**, the ballast **108** includes a container **112**, and a catch plate **114**. The container **112** includes one or more sides **116**, **118**, and **122**. The container is configured to store a heavy mass of material therein. In one embodiment, the container **112** is box-shaped including a top side **116**, lateral sides **118**, and a bottom side **122**. The catch plate **114** is spaced apart and rigidly attached to the container **112** to define at least one pocket **124** therebetween. The pockets **124** are configured to allow one or more lifting implements **126** to be inserted such that the container **112** may be hoisted and selectively coupled to the chassis **106**.

In an exemplary embodiment as shown in FIG. **2**, the pockets **124** defined between the catch plate **114** and the container **112** may be a pair of hollow square passages. The lifting implements **126**, for example, forks **128** of a forklift machine **130**, may be inserted into the hollow square passages and raised to a height above a ground surface such that the ballast **108** may be hoisted. Further, the forklift **130** may transport and position the ballast **108** under the chassis **106** for coupling with the chassis **106**. Although in the preceding embodiment, it is disclosed that the pockets **124** may be hollow square passages, it is to be noted that, any shape of the pockets **124** commonly known in the art may be employed depending on the type of lifting implements **126** used to hoist and support the container **112** by lifting the catch plate **114**. Further, in various embodiments, a configuration of the pockets **124**, the catch plate **114**, and the container **112** impart or render the ballast with a lower center of gravity. This lower center of gravity in the ballast **108** may configure the ballast **108** to remain stable while transporting it using the forklift machine **130**.

In an embodiment as shown in FIG. **2**, the ballast **108** includes one or more webbings **132** rigidly attached to the catch plate **114** and one or more of the top and lateral sides **116**, **118** of the container **112**. The webbings **132** impart rigidity and structural strength to the ballast **108** in handling forces experienced during hoisting and coupling the ballast **108** to the chassis **106**. Further, the webbings **132** are configured to handle a weight of the ballast **108** when suspended from the chassis **106** upon coupling of the catch plate **114** thereon.

In an embodiment as shown in FIG. **3**, the ballast **108** further includes a stop plate **134** which may be rigidly attached on a backside **120** of the container **112** or may be rigidly attached to the chassis **106** of the locomotive **100**. In one embodiment, the stop plate **134** may be rigidly attached to the chassis **106** and disposed behind the pockets **124** of the ballast **108**. The stop plate **134** is configured to close the pockets **124** from the backside **120** and act as a stopping mechanism to the lifting implements **126** from travelling deep underneath the locomotive **100** and damaging other equipment when the ballast **108** is positioned under the chassis **106** during while coupling.

In an embodiment as shown in FIG. **3**, the chassis **106** and the catch plate **114** define one or more openings **136**, **138** thereon. These openings **136**, **138** are configured to allow fasteners **140** therein and releasably fasten the catch plate **114** to the chassis **106**. Fastening the catch plate **114** to the chassis **106** thus accomplishes a coupling of the ballast **108** to the locomotive **100**. In the exemplary embodiment as shown in FIG. **3**, the fasteners **140** may be threaded fasteners such as nuts **142**, and bolts **144**. However, the fasteners **140** disclosed herein are merely exemplary in nature and hence, non-limiting of this disclosure. Any type of fasteners **140** or interlocking geometry commonly known in the art may be employed between the ballast **108** and the chassis **106** to releasably couple the catch plate **114** to the chassis **106** of the locomotive **100**.

As shown in FIG. **3**, the ballast **108** further includes a lid **146** on one of the bottom and lateral sides **122**, **118** of the container **112**. In the exemplary embodiment of FIG. **3**, the lid **146** is disposed on the bottom side **122** of the container **112**. However, in alternative embodiments, the lid **146** may be disposed on any one of the lateral sides **118** of the container **112**. The lid **146** can be opened and closed to allow filling or removal of material into and out of the container **112**. Before initiating filling of material into the ballast **108**, the catch plate **114** may be rested on the ground surface to keep the ballast **108** in an inverted position. The lid **146** on the bottom side **122** may be opened to pour material such as, but not limited to, molten metal or liquid concrete into the container **112**, impart mass to the ballast **108** and thereby increase a weight of the ballast **108**. In an alternative embodiment, materials in solid state and form such as, but not limited to, lead pellets or sand, may also be filled in place of liquid material to increase the weight of the ballast **108**.

For the purposes of understanding the various embodiments of the present disclosure, a rail **400** of heavy axle load capacity is shown in FIG. **4**, and a rail **500** of light axle load capacity is shown in FIG. **5** respectively. In one embodiment, the locomotive **100** may move from the rail **400** of heavy axle load capacity to the rail **500** of light axle load capacity. In another embodiment, the locomotive **100** may move from the rail **500** of light axle load capacity to the rail **400** of heavy axle load capacity. Subsequent monitoring of the axle loads by the selective coupling of the ballast **108** onto the chassis **106** of the locomotive **100** when the locomotive **100** moves from the rail **400** to the rail **500** and vice-versa will be explained in the appended disclosure.

In an embodiment as shown in FIG. **4**, the locomotive **100** may be running on the rail **400** of heavy axle load capacity prior to moving onto the rail **500** of lighter axle load capacity of FIG. **4**. In the preceding embodiment, the ballast **108** may be decoupled from the chassis **106** based on an anticipated decrease in the axle load capacity from rail **400** to rail **500**. Decoupling of the ballast **108** may decrease an overall weight of the locomotive **100** thereby decreasing the axle load on each axle **102** of the locomotive **100**.

In another embodiment as shown in FIG. **5**, the locomotive **100** may run on the rail **500** of light axle load capacity before moving onto the rail **400** of heavy axle load capacity of FIG. **4**. In the preceding embodiment, the ballast **108** is coupled to the chassis **106** of the locomotive **100** based on an anticipated increase in the axle load capacity from rail **500** to rail **400**. Coupling the ballast **108** to the chassis **106** may increase the overall weight of the locomotive **100** thereby increasing the axle load on each axle **102** of the locomotive **100**.

As evident from the disclosure pertaining to FIGS. **4**-**5**, the ballast **108** may be coupled or decoupled from the locomotive **100** to impart or remove a second weight to a first unladen weight of the locomotive **100**. Therefore, with specific reference to the locomotive **100** shown in FIG. **5**, the overall weight of the locomotive **100** is a sum of the first unladen weight, and the second weight from the coupled ballast **108**. However, with specific reference to the locomotive **100** shown in FIG. **4**, the overall weight of the locomotive **100** is the first unladen weight of the locomotive **100** alone; since the ballast **108** is decoupled the locomotive **100** and the locomotive **100** travels without the ballast **108** thereon.

In an embodiment, the axle load capacity of the rail **400**/**500** may be defined by a range from a maximum axle load capacity to a minimum axle load capacity. Therefore, in various embodiments disclosed herein, the second weight of the ballasts **108** may be implemented such that the axle load of the locomotive **100** lies between the maximum and minimum axle load capacity of the rail **400**/**500**.

Therefore, in this embodiment, the second weight of the ballasts **108** may be determined based on the axle load capacity of the rail **400**/**500** and the first unladen weight of the locomotive **100**. A person having ordinary skill in the art may acknowledge that the second weight of the ballasts **108** may depend on a mass of material being filled into the container **112**. Thus, determining a specific mass of material to fill the container **112** may be done by co-relating the first unladen weight of the locomotive **100** and the axle load capacity of the rail **400**/**500**. By co-relating and determining a weight of the ballast **108**, the ballast **108** may be configured to maintain the axle loads of the locomotive **100** between the maximum and minimum axle load capacity of the rails **400**/**500** when coupled to the locomotive **100**.

INDUSTRIAL APPLICABILITY

Axle load capacities of rails vary from one rail to another. A first rail may be able to withstand a heavy axle load of a locomotive while a second rail may be able to withstand a lighter axle load as compared to the first rail. However, each axle of the locomotive may need to confirm to the axle load capacity requirements of the rail at all instants of time.

Typically, industrial locomotives used to pull cargo containers may comply with different axle load capacities of one or more rails by involving a transfer of contents from larger cargo containers to smaller containers or vice-versa such that the axle loads associated with the containers comply with the anticipated axle load capacity of the onward rail. However, the axle load on each axle of the locomotive may still remain unchanged and hence be non-compliant with the axle load capacity of the rail.

The axle loads on the axles of the locomotive also manifest themselves as an influence on adhesive force between wheels of the locomotive and the rail to improve a tractive effort of the locomotive. When individual axle loads of the locomotive are lesser than the minimum axle load capacity of the rail, insufficient adhesion and traction may occur between the wheels and the rail. Consequently, the wheels of the respective axles may slip on the rail causing difficulty in hauling the containers. Conversely, when individual axle loads of the locomotive exceed the maximum axle load capacity of the rail, the rail may be subject to one or more negative or detrimental effects such as premature failure.

In the locomotive **100** of the present disclosure, the axle loads may be varied by selectively coupling the ballasts **108** to the chassis **106**. Further, when manufacturing the ballast **108** and adding a mass of material therein, a weight of the ballast **108** is determined and selected beforehand such that a number of such ballasts **108** may be coupled to the locomotive **100** to make the individual axle load compliant of the locomotive **100** with the anticipated axle load capacity of the onward rail **400/500**.

In alternative embodiments, the ballasts **108** also may be of different weights such that a combination of ballasts **108** may be coupled or decoupled from the locomotive **100** to achieve a finer degree of control in maintaining the overall weight of the locomotive **100**. The finer degree of control may be helpful in cases where the axle load capacity of the rail **400/500** is defined by the maximum and minimum axle load capacity respectively. Further, the ballasts **108** of different weights may be used to adjust the mass across a front to a rear, and from side to side of the locomotive **100**. In this manner, a weight of the locomotive **100** may be equally balanced on all sides.

Coupling or de-coupling of the ballasts **108** onto the locomotives **100** may be performed by an operator at train stations or any suitable locomotive **100** yard. Further, lifting implements **126** such as the forklift **130** or any other type of lifting implements **126** commonly known in the art may be used to hoist, transport, and position the ballasts **108** beneath the locomotive **100** for coupling with the chassis **106**. Thus, an operator may easily and conveniently use the ballasts **108** disclosed herein to vary the individual axle loads of the locomotive **100** based on changes in the axle load capacities of the rails **400/500**.

Conventional locomotives are known to have one or more fluid lines running along an underside of the locomotive. These fluid lines are for example, but not limited to, brake lines, oil lines and the like. In addition, other equipment such as brake control racks and electrical cables may be located along the underside of the locomotive **100**. The stop plate **134** at the backside **120** of the ballast **108** disclosed herein may prevent any lifting implements **126** from going too far on the underside of the locomotive **100** and damaging the fluid lines or other equipment. Thus, when a forklift **130** is used to hoist and position the ballast **108** beneath the chassis **106**, the forks **128** may be stopped by the stop plate **134** from penetrating too far and damaging the fluid lines or other equipment. Therefore, a possibility of damage to components mounted beneath the chassis **106** is mitigated.

While aspects of the present disclosure have been particularly shown and described with reference to the embodiments above, it will be understood by those skilled in the art that various additional embodiments may be contemplated by the modification of the disclosed machine, systems and methods without departing from the spirit and scope of what is disclosed. Such embodiments should be understood to fall within the scope of the present disclosure as determined based upon the claims and any equivalents thereof.

I claim:

1. A ballast configured to be selectively coupled to an underside of a chassis of a locomotive based on an anticipated change in axle load capacity of a rail, the ballast comprising:

a container including one or more sides, the container storing a heavy mass of material, wherein the weight of the heavy mass of material is provided based on the anticipated change in the axle load capacity of the rail;

a lid disposed on one of a bottom and lateral sides of the container; and

a catch plate disposed above, spaced apart and rigidly attached to the container to define at least one pocket therebetween above a top side of the container, the at least one pocket configured to allow one or more lifting implements to be inserted such that the ballast may be hoisted by the catch plate and the catch plate of the ballast selectively coupled to the underside of the chassis.

2. The ballast of claim **1**, wherein the container is box-shaped.

3. The ballast of claim **1**, wherein the lid is configured to be opened and closed to allow filling or removal of material into and out of the container.

4. The ballast of claim **1** further including one or more webbings rigidly attached to the catch plate and one or more of a top side and the lateral sides of the container.

5. The ballast of claim **1**, wherein the catch plate defines one or more openings thereon, the openings configured to allow fasteners therein and releasably fasten the catch plate to the underside of the chassis.

6. The ballast of claim **1**, wherein the ballast is configured to be coupled to the underside of the chassis of the locomotive based on an anticipated increase in the axle load capacity of the rail.

7. The ballast of claim **1**, wherein the ballast is configured to be decoupled from the underside of the chassis of the locomotive based on an anticipated decrease in the axle load capacity of the rail.

8. The ballast of claim **1**, wherein the ballast is configured to be selectively coupled to the underside of the chassis of the locomotive such that an axle load of the locomotive lies between a maximum and minimum axle load capacity of the rail.

9. The ballast of claim **8**, wherein a weight of the ballast is determined based on the axle load capacity of the rail and an unladen weight of the locomotive.

10. A locomotive configured to run on a rail, the locomotive including:

two or more axles;

a chassis disposed on the axles and having an underside;

one or more ballasts selectively coupled to the underside of the chassis based on an anticipated change in axle load capacity of the rail, the ballast including:

a container including one or more sides, the container configured to store a heavy mass of material;

a lid disposed on one of a bottom and lateral sides of the container; and

a catch plate disposed above, spaced apart and rigidly attached to the container to define at least one pocket therebetween above a top side of the container, the at least one pocket configured to allow one or more lifting implements to be inserted such that the ballast may be hoisted by the catch plate and the catch plate of the ballast selectively coupled to the underside of the chassis.

11. The locomotive of claim **10**, wherein the container is box shaped.

12. The locomotive of claim **10**, wherein the lid is configured to be opened and closed to allow filling or removal of material into and out of the container.

13. The locomotive of claim **10** further including one or more webbings rigidly attached to the catch plate and one or more of a top side and the lateral sides of the container.

14. The locomotive of claim **10** further including a stop plate rigidly attached to the underside of the chassis and disposed behind the pockets of the ballast and positioned to stop the ballast from travelling deep underneath the locomotive when the ballast is positioned under the chassis during coupling.

15. The locomotive of claim **10**, wherein the chassis and the catch plate define one or more openings thereon, the openings configured to allow fasteners therein and releasably fasten the catch plate to the chassis.

16. The locomotive of claim **10**, wherein the ballast is coupled to the underside of the chassis of the locomotive based on an anticipated increase in the axle load capacity of the rail.

17. The locomotive of claim **10**, wherein the ballast is decoupled from the underside of the chassis of the locomotive based on an anticipated decrease in the axle load capacity of the rail.

18. The locomotive of claim **10**, wherein the ballast is configured to be selectively coupled to the underside of the chassis of the locomotive such that an axle load of the locomotive lies between a maximum and minimum axle load capacity of the rail.

19. The locomotive of claim **18**, wherein a weight of the ballast is determined based on the axle load capacity of the rail and an unladen weight of the locomotive.

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